Blueshift - Episode 6

[music]

Sara: It's time for another episode of Blueshift - the NASA podcast that brings the Universe closer to you! I'm Sara Mitchell.

Steve: And I'm Steve Fantasia. We're coming to you from NASA's Goddard Space Flight Center in Greenbelt, Maryland, where we can offer you a "behind the scenes" peek at how space science is done.

Sara: We're ready to ring out the old year and ring in the new, NASA-style. First, we'll say farewell to an old friend. NASA's Far Ultraviolet Spectroscopic Explorer just ended operations after 8 successful years in orbit.

Steve: Next, we'll see what new missions are in the works, and take a look at how NASA missions go from the drawing board to spaceflight.

Sara: We'll do some snooping to find out what happens during a typical day in science around here.

[music]

Steve: On October 18, 2007, NASA's Far Ultraviolet Spectroscopic Explorer ceased operations. FUSE, as the satellite was affectionately known, brought us a completely new perspective on the Universe during its 8 years in orbit. Project Scientist George Sonneborn talked with us about FUSE's mission and legacy.

Joel: What was the FUSE project? Can you give us a short description?

George: Happy to. FUSE was a small NASA telescope to explore the Universe in the far ultraviolet wavelength band. This is a part of the spectrum that cannot be seen by Hubble. FUSE was designed and built by the scientists at Johns Hopkins University, and it was launched in 1999 for a three year mission. FUSE was used by hundreds of scientists around the world.

Joel: What do you think were the most important or most interesting discoveries made by FUSE?

George: My favorite discovery from FUSE was the first measurement of molecular hydrogen in the atmosphere of Mars. This showed that Mars used to have enough water to cover the planet 100 feet deep. The most significant discovery from FUSE, I think, is the study of the deuterium atom in the Milky Way Galaxy.

Joel: Why was FUSE turned off?

George: Several essential parts of the satellite that point the telescope have failed over the last five years. The last one ceased to work in July 2007, which made it impossible to achieve the precision pointing needed for the science observation.

Joel: What's going to happen to the FUSE data now?

George: All the observations have been calibrated and archived, and they're available to astronomers and the public from the science archive at the Space Telescope Science Institute in Baltimore, Maryland.

Joel: What's next for the FUSE team and for yourself?

George: Well, right now I'm one of the project scientists working on the James Webb Space Telescope. Other members of the FUSE team are supporting other new missions like SOFIA and the Hubble servicing mission. And many of us are working on new mission concept studies.

Joel: Dr. Sonneborn is an astrophysicist at NASA's Goddard Space Flight Center with the Astrophysics Science Division. For Blueshift, I'm Joel Offenberg.

Steve: Ever wonder how missions like FUSE get started in the first place? Does the idea come from NASA? The President? Cocktail party conversations?

Sara: All those and more, actually. But once someone has an idea, it's a long and eventful process to go from drawing board to launch pad. Joining me now is Anita Krishnamurthi, who went around with me to talk to people at Goddard working on various missions.

Anita: We just heard about FUSE, which was turned off earlier this year. But in the hallways and labs here, people are working on projects in every stage of life. To learn more about this process, we talked with four scientists working on four very different missions.

Sara: We started by talking to Joe Hill, who is currently deep into the process of proposing a new mission. Where do the ideas come from for these?

Joe: Well, many of us it goes as far back as what you did perhaps for your PhD. For me, I did polarimetry for my PhD, and then I worked on Swift, which was gamma ray bursts, and now I'm back doing polarimetry. And as you develop the detectors and the hardware, and listening to the science talks, you hear key questions that need to be answered. And so then it triggers an idea about what it is you would need to build to answer those questions.

Sara: Joe has taken her ideas and is currently writing a proposal that's due in January 2008. So what happens next?

Joe: The whole SMEX that we're working to now, Small Explorer, you find out in January '09 if you won or not, and the launch, first launch opportunity, is 2012. So you don't really have any time to waste. And so you figure out what your requirements are, exactly, okay these are our science requirements, how does that flow down to the instruments, what does that really mean, and really get them defined well. And then you do your design, and for sixteen months basically you establish how you're going to design it to survive the vibration loads, the thermal loads. And after sixteen months you have a review and then they say, "Okay, your design is good enough. Now you can spend some real money and start building this thing." But NASA really wanted to make sure that they understand what it is you're trying to do, and that you can achieve it before you start putting pieces of metal together and really building this thing.

Anita: We wanted to find out what happens after a mission concept is approved. So we talked with Jonathan Gardner, Deputy Project Scientist for the James Webb Space Telescope. Webb is scheduled to be launched in 2013, but the idea for it came about a very long time before that.

Jonathan: The origins of the James Webb Space Telescope started in 1989, when people thought about what is going to come after the Hubble Space Telescope. The contract to build the Webb telescope was signed in 2002.

Anita: People are currently working very hard on getting Webb ready for that 2013 launch. Jon told us what's happening right now.

Jonathan: Well, we're in a very exciting time on the James Webb Space Telescope project. We are finishing the design and starting to build things. We are cutting out the primary mirror from beryllium, and polishing the segments of the telescope. The cameras are just starting to go into final design stage, the construction and the testing, we're choosing the flight detectors, and so there's a lot of progress being made right now. In the next few year, we'll then start to put all of these pieces together.

Sara: As the launch date nears, the excitement grows! I talked with Dave Thompson, who is working on the GLAST mission. When exactly are you planning to launch, Dave?

Dave: We have a manifest date of May 29th.

Sara: What's left to do?

Dave: We're down to the last big test. This is called "thermal vacuum," where we simulate the space environment and make sure that everything works under all of those conditions.

Sara: After that, then it's time for launch?

Dave: After that, we pack it up and ship it to the Cape, in Florida, and get ready for launch.

Sara: So you must be really excited.

Dave: Oh, absolutely. We're looking forward to this launch.

Sara: How long do you expect to be taking data?

Dave: We'd like to take data forever, but in practice we will take data for a minimum of five years, and we've got everything built and planned for a ten year mission.

Anita: So far, we've heard about three missions that have not been launched as yet. But once the missions is in space, what's left to do? Padi Boyd talked about the Swift mission, and what happens when the Burst Alert Telescope, or BAT, finds something interesting. Since this is a mission in full swing, what do people working on this do on a day-to-day basis?

Padi: Once BAT has detected a burst, it sends a message down to the ground, through the TDRSS satellites, and we all have our cell phones hooked up so that we get beeps. And then no matter when it happens, people get on the phone for a telecon, and everybody looks at the data very quickly and decides whether this is an interesting burst. And then after we all go back to bed, and resume our normal lives, people write reports on those and analyze the data. And also a lot of science planning happens, every day there's a telecon to decide what the satellite is going to look at for the next few days.

Anita: So what's next for Swift?

Padi: Swift has, in addition to all the gamma ray burst discoveries, is also looking at interesting non-gamma ray burst targets. And what we'd like to do next is to put more emphasis on that type of science.

Anita: So there you have it - a glimpse into the life cycle of NASA missions from the beginning to the end.

Sara: Although, there never really is an end. Scientists continue to study the data from FUSE, and who knows what exciting discoveries are waiting. Missions generate new questions that the next mission might just come along and answer.

[music]

Steve: Now that we've covered the typical life of a mission at NASA, what about the typical day for a NASA employee? You might imagine people gathered around computers or whiteboards, solving the mysteries of the Universe.

Sara: Well, there's some of that. But there are other things, too, and you'd be surprised how familiar a few of them are. One of our Blueshift team members takes an inside look at a day in the life of NASA's science staff.

Gail: This is Gail Rohrbach, a contractor at Goddard Space Flight Center. We're going to find out, what do people actually do in a typical day here in the Astrophysics Science Division. I'm standing outside of Building 2 at Goddard, we're going to go in and just ask people, "What have you been doing today?

[door shuts]

Padi Boyd: I came to work for the first time in a week, because I was on vacation, I checked my voicemail and had 9 messages, a couple of them were from NASA headquarters so I had to call them back. Then I spent part of the day reviewing a whole bunch of documents that I have to be up to speed on very soon, answered hundreds, well, went through hundreds of email and answered ten or twenty.

Craig Markwardt: I work with the Swift BAT, BAT is an instrument on the Swift observatory, and Swift has had some problems recently and I've been helping to restore the BAT to its full capabilities again. That involves turning on the instrument and reprogramming the computer so that it can chase gamma ray bursts.

Simon Bandler: I'm Simon Bandler, and yesterday and today I've been working on the first draft of a paper that we are presenting at SPAE next week on microcalorimeter arrays that we've achieved breakthrough performance in recently.

Stephen Holland: I was looking at the optical afterglows of a gamma ray burst.

Frank Marshall: I was trying to compile a catalog of afterglows.

Caroline Kilborne: And I worked on a presentation for a status report on some detectors that are being developed for a future X-ray spectroscopy mission known as Constellation-X.

Koji Mukai: I work for the US-Japanese Suzaku mission. Yesterday, one thing I did was to translate some English emails to Japanese for our colleagues in Japan. On the research side, I've been editing a web-based catalog of a certain class of objects. It's a very specialized catalog with a bibliography.

Eric Winter: And yesterday, I spent quite a bit of time in online meetings, reading some old papers about a mission called GLAST, and working on software to let astronomers model gamma ray sources in the sky.

Pat Tyler: Bought computers all day long, same thing I've all day done today. Because the computer that I've got is about four years old, three years old, between that, and it's crashing every five minutes.

Robin Corbet: I spent most of my time attending meetings for the GLAST satellite. GLAST is the Gamma-Ray Large Area Space Telescope, it's going to be launched early next year. It's going to be a big improvement on the missions that have gone before.

Padi Boyd: And I started to organize the Swift and XTE proposal review.

Gail: Busy day?

Padi: Busy day.

Steve: If that segment left you wondering what a gamma ray burst was, or who had that sultry voice, check out our web site, where we've got links to all the people and science just mentioned. You can find us on the Web at universe.nasa.gov/blueshift , where we've got further info on the stuff covered in today's podcast, and a feedback button.

Sara: Ooh, feedback! Send us your opinions! Questions! Suggestions for future episodes!

Steve: Contributions! Accolades! Awards!

Sara: Nice try, Steve - we actually can't solicit any of that. But we would love to know what you think. So drop us a line via our feedback link.

Steve: This is Steve Fantasia, wishing everyone a happy and healthy new year!

Sara: And may we all continue to watch the skies with wonder. I'm Sara Mitchell. You've been listening to Blueshift - the NASA podcast that brings the Universe closer to you.

[music]